#2122/76

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

Institute for Computer
Sciences and Technology

Chief of ADP Control Officers (ODP-2139-76)

1976 October 13

STAT

MEMORANDUM FOR FIPS Points of Contact

From: Harry S. White, Jr.
Associate Director for ADP Standards

Subject: Coordination of Proposed Standard for OCR Paper

Enclosed for your consideration is a proposed standard for Optical Character Recognition (OCR) Paper. This standard is the Federal adoption of American National Standard BSR X3.62-197_. See attached draft which is awaiting final approval by the American National Standards Institute.

This proposed standard provides the requirements and test procedures for paper to be used in Optical Character Recognition (OCR) Systems and is applicable to all ADP systems using OCR systems as integral input/output media processing of typed, lineprinted, imprinted, or handprinted character data.

In order to ensure that all agencies have an opportunity to present their views, NBS is soliciting your comments on this proposal. If you find that your agency cannot concur with this proposed standard, please indicate specific changes that you feel are needed.

Also please indicate to what extent this proposed standard is applicable to your agency and the expected impact it will have on increasing the efficiency and economy of your ADP systems operations.

Please submit your comments within ninety days of the date of this memorandum to:

Associate Director for ADP Standards
Institute for Computer Sciences and Technology
National Bureau of Standards
Washington, D.C. 20234

Concurrences will be assumed if a response is not received by this date.

Enclosure

cc: State Information Systems Coordinators

ANSI

American National Standard

OCR paper

FINAL DRAFT

american national standards institute
1430 broadway, new york, n.y. 10018

ANSI
X3A1/75-103
1976-02-27 Revised

FINAL DRAFT

American National Standard OCR paper

Secretariat
Computer & Business Equipment Manufacturers Association

Approved
American National Standards Institute, Inc

Approved For Release 2002/05/17 : CIA-RDP83T00573R000600200013-3

American National Standard

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Published by

American National Standards Institute
1430 Broadway, New York, New York 10018

Approved For Release 2002/05/17 : CIA-RDP83T00573R000600200013-3

FOREWORD

(This Foreword is not a part of American National Standard Optical Character Recognition Paper, X3.XX-197X.)

This American National Standard presents specifications and recommendations for papers to be used in optical character recognition applications. It is a revision and expansion of the Paper Specifications contained in American National Standard Character Set and Print Quality for Optical Character Recognition (OCR-A), X3.17-1974. Since optical character recognition papers are font-independent it is appropriate that a separate optical character recognition paper standard be established.

Suggestions for improvement of this standard will be welcome. They should be sent to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

This standard was processed and approved for submittal to ANSI by American National Standards Committee on Computers and Information Processing, X3. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the X3 Committee had the following members:

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CONTENTS

AMERICAN NATIONAL STANDARD
OPTICAL CHARACTER RECOGNITION PAPER

1. INTRODUCTION

1.1 Purpose

The purpose of this standard is to establish the requirements and test procedures for paper to be used in Optical Character Recognition (OCR) Systems.

1.2 Scope

This standard contains basic definitions, measurement requirements, specifications, and recommendations for papers used with optical character readers.

Two types of parameters of paper for OCR media are covered. These are:

(1) The Optical properties of paper for OCR usage.

(2) The physical properties of paper for OCR usage.

In addition, OCR papers are classified into three categories (i.e., Types I, II, and III) according to allowable dirt and fluorescent content.

1.3 Application

Because of the widely divergent nature of OCR applications, this standard may not include all of the necessary or prudent specifications or considerations for a successful OCR system. The values in this standard are chosen on the basis that they are reasonably obtainable. Although each parameter is independently specified, a deterioration in reader performance may occur if the limits of one or more parameters are approached simultaneously. Where new OCR equipment or a new paper is involved, consultation between users, suppliers, and manufacturers is recommended.

2. PAPER SPECIFICATIONS

2.1 General

A white, 100% wood pulp paper without watermarks,

embossed or printed patterns, or fluorescent additives is recommended for OCR applications.(1)

2.2 Sampling

Samples shall be taken in such a manner as to be representative of a lot and an area of paper selected sufficient to obtain a single adequate set of test results for all the properties to be measured. Acceptable sampling methods are TAPPI (Standard T400 ts-64) and ASTM (Standard D585-68).

2.3 Test Conditions

Test conditions shall be $73.4 \pm 1.8^{\circ}F$ ($23^{\circ}C \pm 2^{\circ}C$) temperature and 50% ± 2% relative humidity. Both temperature and relative humidity have significant effects on the physical properties of paper. For very precise determination of physical properties, a specified preconditioning is necessary and the procedure given in TAPPI (Standard T402 os-70) and ASTM (Standard D685-73) should be followed.

2.4 Classification of OCR Papers

The two primary paper characteristics which set OCR papers apart from other high quality grades of paper are dirt level and fluorescent content. The specifications given in this standard for all other paper characteristics would, therefore, be representative of any good quality paper, whether for OCR or non OCR use.

It is also recognized that some OCR readers and some OCR applications are more tolerant of dirt and/or fluorescence in paper than others. In recognition of this fact, three classifications of OCR papers are suggested. Type I OCR papers would be required where there is a low tolerance to both dirt and fluorescence. Type II OCR papers could be used where there is a low tolerance to fluorescence but a higher tolerance to dirt. Type III OCR papers could be used where there is a higher tolerance to both dirt and fluorescence.

The OCR equipment manufacturer, user, and forms supplier should determine which of the three levels is suitable for a given application.

(1) While rag content papers are not generally recommended for OCR applications they are used in stock certificates, bonds, and similar applications where optical scanning is used. In addition, in some special OCR applications fluorescent materials are intentionally added to the paper for identification purposes. Lightly tinted papers may be used if they meet the paper reflectance requirements described in paragraph 2.5.1.

2.5 Optical Properties

2.5.1 Paper Reflectance

An optical reader will usually be responsive to a restricted band of optical wavelengths. Typically, readers respond to radiant energy having wavelengths in either the near ultraviolet, blue-green, green, or near infrared regions of the spectrum. It is a fundamental requirement, therefore, that the paper used for OCR be a good reflector in the wavelength ranges of the optical reader's response.

The term paper reflectance in this standard refers to the diffuse reflectance factor, i.e., the receiver used for measurement shall exclude specularly reflected light. Reflectance measurements shall be referred to the perfect reflecting diffuser (100% reflectance). However, in practice barium sulphate ($BaSO_4$) may be used with sufficient accuracy. In case of disagreement, the measurements shall be based on the perfect reflecting diffuser.

Paper reflectance measurements shall be made using the infinite pad method, i.e., the samples being measured should be backed with a sufficient number of paper thicknesses of the same type of paper such that doubling the number will not change the measured value of reflectance. Reflectance may be determined either by means of spectrophotometric measurements, or by a number of reflectance measurements in different spectral bands. (See American National Standard Z138.2-1969 (R1974) Reaffirmed July 29, 1974. "Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System")

2.5.1.1 Visual Spectrum

The average reflectance of the paper shall not be less than 60% in the range from 425 nm to 500 nm, and shall be not less than 70% in the range from 500 nm to 700 nm.

2.5.1.2 Infrared Spectrum

When the near infrared (IR) spectrum is of interest, an average reflectance of 70% in the range from 700 nm to 1200 nm is required.

2.5.2 Fluorescence

Fluorescence can adversely affect the reading and/or sorting capabilities of certain OCR systems. Therefore, fluorescent

additives should not be used in OCR papers. (2) It is recognized, however, that a certain degree of fluorescent contamination may be unavoidable in the papermaking process.

For type I and type II OCR papers, fluorescent contamination should not result in more than a 2.0% difference in reflectance when measured with and without the ultraviolet component of a light source of 3100° Kelvin in combination with a C.I.E. Z (blue) filter. For type III OCR papers, fluorescence should not result in more than a 5.0% difference in reflectance. (See section A1.2 in the Appendix for a discussion of OCR paper type classifications).

2.5.3 Paper Opacity (Reference TAPPI T425-m-60)

Paper opacity is defined as the ratio of the diffuse reflectance of a specimen backed with a black material of not more than 0.5% reflectance to the diffuse reflectance of the same specimen backed with a white body having an absolute reflectance of 89%.

Opacity is indicative of the effect on paper reflectance of the backing material. If the paper transport system of the OCR device is such that a known uniform highly reflective surface is provided at the time of reading, a medium opacity paper may be usable. However, some systems scan paper backed by other printing, or have a transport system that provides a non-uniform or low reflectance backing surface. For such cases a high opacity paper should be used.

The minimum opacity required for an OCR paper will depend upon the OCR device used and the application. In general, opacity is related to the basis weight of the paper; the higher the basis weight the greater the opacity.

In general, paper having opacity exceeding 85% should be used. Papers of lower opacity should be used only if needed for application and after considering the optical system. Papers having opacity less than 65% should not be used.

Many inks have the property of permeating the paper to a considerable depth. Applications requiring printing on both sides may require a higher paper opacity to compensate for this effect.

(2) See footnote on page 2.

Typical OCR paper opacity values are given in tables 1 thru 5.

2.5.4 Paper Gloss

Gloss is the property of a surface responsible for a lustrous or mirror-like appearance. It is a phenomenon related to the specular reflection of the incident light. The effect of gloss is to reflect more of the incident light in a specular manner, and to scatter less. It occurs at all angles of incidence and should not be confused with grazing angle specular reflection that is often referred to as sheen. Paper gloss is undesirable for OCR systems since it affects diffuse reflectance adversely, thus affecting the print contrast signal.

Paper for OCR should be restricted to low gloss varieties such as normally found in uncoated bonds, ledgers, index, journal tape, tag and tabulating stock.

2.5.5 Dirt in Paper

Dirt in paper can be a critical factor in some OCR applications. As discussed in Section 2.4, two levels of dirt tolerance are recognized. Type I OCR papers would be required where there is a low tolerance to dirt. Type II or type III OCR papers could be used where there is a higher dirt tolerance. It is recommended, that concurrence of the OCR equipment manufacturer be established before type II or type III OCR papers are used.

Dirt is defined as relatively non-reflecting foreign particles embedded in the paper. Since the lack of reflectance and the size of such particles may cause them to be mistaken for inked areas by an OCR reader, it is important that both their frequency and size be small.

There are two primary methods for measuring dirt in general use in the United States; these are, the dirt in paper method of TAPPI (Standard T437 ts-63); and the mark count method. In the TAPPI method the area of the dirt is estimated in terms of equivalent black area and expressed in parts per

million. Only those dirt specks having an equivalent black area of 0.000062 sq. in. (0.04 sq. mm) or larger are considered. The mark count method expresses dirt in terms of the average number of marks or embedded dirt specks per 1,000 sq. in. (6,452 sq. cm) of paper. All visible imperfections exceeding 0.000016 sq. in. (0.01 sq. mm) in area are counted.

Both of the above methods are subjective in that they rely on the vision of the person making the test. Differences in perception, eye fatigue, lighting conditions, and the care with which observations are made can greatly affect reproducibility by different people. Controlled comparisons on identical samples have resulted in test errors of 200% to 300%. Because of the lack of precision and reproducibility in measuring dirt of this size, dirt specifications have not been included in the body of this standard. Commonly quoted dirt requirements, however, have been included in Appendix A as a guide. When more precise and reproducible dirt count methods are developed--preferably by instrumentation, the practicality of these requirements can be evaluated and appropriate specification limits incorporated in this standard.

2.6 Physical Properties

Certain physical properties of paper such as basis weight, caliper, smoothness, tear, porosity, and stiffness may be significant in OCR applications.

2.6.1 Basis Weight

The commercial terminology for expressing the weight per unit area of paper has been basis weight, defined as the weight of a given size sheet in pounds per ream (usually 500 sheets). For OCR papers this is normally the weight in pounds of 500 - 17" x 22" sheets. The metric system for weight per unit area, expressed as grams per square meter (grammage) is now the preferred system for technical standards. Acceptable test methods are TAPPI (Standard T410 os-68) and ASTM (Standard D646-67).

2.6.2 Caliper

Caliper or thickness of paper is defined as the perpendicular distance between the two principal surfaces of the

paper under prescribed conditions of pressure. Acceptable test methods are TAPPI (Standard T411 os-68) and ASTM (Standard D645-67).

2.6.3 Smoothness

Smoothness of paper, is defined as the time required for a fixed volume of air to leak across the surface of a paper sample. It is recorded as the number of cubic centimeters of air per minute flowing over one square inch of paper area, multiplied by ten. An acceptable test method is TAPPI (Useful Method UM-518 or Routine Control Method RC-285).

2.6.4 Porosity

Porosity of paper is defined as the resistance of paper to the passage of air under a specified pressure through the paper. It is reported as the average time in seconds required to displace 100 ml of air through one square inch of paper area under pressure of 4.88 inches (12.4 cm) of water.
Acceptable methods are TAPPI (Standard T460 os-68) and ASTM (Standard D726-58, reapproved in 1971).

2.6.5 Stiffness

Stiffness of paper is defined as the bending moment which the paper can withstand in both directions by deflecting a small weighted pendulum. See Manufacturer's Test Procedure.

2.6.6 Tearing Resistance

Tearing resistance is defined as the average force in grams required to tear a single sheet of paper after the tear has been started. Acceptable test methods are TAPPI (Standard T414 ts-65) and ASTM (Standard D-689-62, reapproved 1968).

2.7 Typical OCR Paper Characteristics

These typical OCR paper characteristics are directed to the use of documents in interchange applications. The selected values are a compromise to define a paper with adequate characteristics for manual handling, machine processing, printing, and encoding. The values given in the subsequent tables are intended to serve only as a guide. With the differences in available pulps and

processing equipment in paper mills it is possible that papers with somewhat different values in one or several tests might work satisfactorily on some OCR scanners. The values shown in the following tables, therefore, indicate a range of data which from experience generally produces satisfactory results. Papers which have parameters differing greatly from the typical OCR Paper Characteristics should be carefully checked for their suitability on the OCR scanner for which they are intended.

TABLE 1

TYPICAL OCR PAPER CHARACTERISTICS - BONDS AND LEDGERS*

Basis Weight† 500 Sheets 17 x 22 in	Property Values and Test Methods Used							
	Opacity (Bausch & Lomb) Min	Smoothness‡ (Sheffield) Min	Smoothness‡ (Sheffield) Max	Porosity (Gurley) Min	Stiffness, Either Direction (Gurley) Min	Tear, Either Direction (Elmendorf) Min	Caliper,§ Nominal Min	Caliper,§ Nominal Max
15 lb (56.4 g/m^2)	72%	100	200	10 sec	25 mg	25 g	0.0027 in	0.0035 in
20 lb (75.2 g/m^2)	82%	100	200	10 sec	50 mg	40 g	0.0034 in	0.0043 in
24 lb (90.2 g/m^2)	85%	100	200	10 sec	100 mg	50 g	0.0043 in	0.0052 in
28 lb (105.3 g/m^2)	88%	100	200	15 sec	150 mg	60 g	0.0050 in	0.0061 in
32 lb (120.3 g/m^2)	90%	100	200	15 sec	200 mg	70 g	0.0056 in	0.0069 in

*For a complete definition of typical OCR paper qualities, including dirt, reflectance, and fluorescence requirements, it is imperative that Section 2 and Appendix A be read in their entirety.

† Tolerance for this characteristic is ± 5% of nominal value.

‡ Certain OCR devices and applications may require a narrower range. Results are reported in Sheffield flow units.

§ Normal paper manufacturing tolerance within a run is ± 5% of nominal caliper. The tolerance for 15 lb and 20 lb is ± 7%.

TABLE 2

TYPICAL OCR PAPER CHARACTERISTICS - TAG AND TABULATING STOCK*

Basis Weight† 500 Sheets 24 x 36 in	Property Values and Test Methods Used							
	Opacity (Bausch & Lomb) Min	Smoothness‡ (Sheffield) Min	Smoothness‡ (Sheffield) Max	Porosity (Gurley) Min	Stiffness, Either Direction (Taber) Min	Tear, Either Direction (Elmendorf) Min	Caliper,§ Nominal Min	Caliper,§ Nominal Max
80 lb (130.2 g/m^2)	87%	100	200	15 sec	4 g-cm	110 g	0.0055 in	0.0070 in
100 lb (162.7 g/m^2)	88%	70	210	30 sec	7 g-cm	140 g	0.0068 in	0.0080 in
125 lb (203.4 g/m^2)	92%	70	230	40 sec	16 g-cm	175 g	0.0084 in	0.0100 in
99 lb (161.1 g/m^2) (Tab Stock)**	91%	-	125	50 sec	8 g-cm	125 g	0.0066 in	0.0074 in

*For a complete definition of typical OCR paper qualities, including dirt, reflectance, and fluorescence requirements, it is imperative that Section 2 and Appendix A be read in their entirety.

† Tolerance for this characteristic is ± 5% of nominal value.

‡ Certain OCR devices and applications may require a narrower range. Results are reported in Sheffie flow units.

§ Normal paper manufacturing tolerance within a run is ± 5% of nominal caliper.

**Specifications for tabulating card stock are contained in American National Standard Specifications for General Purpose Paper Cards for Information Processing, X3.11-1969, or Federal Specification G-C-116, Card, Tabulating; Federal Stock Number 7530-181-8930.

TABLE 3

TYPICAL OCR PAPER CHARACTERISTICS - INDEX STOCK*

Basis Weight† 500 Sheets 25-1/2 x 30-1/2 in	Property Values and Test Methods Used							
	Opacity (Bausch & Lomb) Min	Smoothness‡ (Sheffield) Min	Smoothness‡ (Sheffield) Max	Porosity (Gurley) Min	Stiffness, Either Direction (Taber) Min	Tear, Either Direction (Elmendorf) Min	Caliper,§ Nominal Min	Caliper,§ Nominal Max
90 lb (162.7 g/m^2)	92%	70	200	20 sec	4 g-cm	120 g	0.0065 in	0.0086 in
100 lb (180.8 g/m^2)	94%	70	200	20 sec	13 g-cm	140 g	0.0080 in	0.0098 in
110 lb (198.8 g/m^2)	94%	70	200	20 sec	20 g-cm	160 g	0.0095 in	0.0130 in

*For a complete definition of typical OCR paper qualities, including dirt, reflectance, and fluorescence requirements, it is imperative that Section 2 and Appendix A be read in their entirety.

† Tolerance for this characteristic is ± 5% of nominal value.

‡ Certain OCR devices and applications may require a narrower range. Results are reported in Sheffield flow units.

§ Normal paper manufacturing tolerance within a run is ± 5% of nominal caliper.

TABLE 4

TYPICAL OCR PAPER CHARACTERISTICS - RAG PAPERS*

	Property Values and Test Methods Used				
Basis Weight † 500 Sheets 17 x 22 in	Opacity (Bausch & Lomb) Min	Porosity (Gurley) Min	Tear, Either Direction (Elmendorf) Min	Caliper, ‡ Nominal Min	Max
25 lb (94.0 g/m^2)	87%	150 sec	100 g	0.0050 in	0.0056 in

*For a complete definition of typical OCR paper qualities, including dirt, reflectance, and fluorescence requirements, it is imperative that Section 2 and Appendix A be read in their entirety. While rag content papers are not generally recommended for OCR applications they are used in stock certificates, bonds, and similar applications where optical scanning is used.

† Tolerance for this characteristic is ± 5% of nominal value.

‡ Normal paper manufacturing tolerance within a run is ± 5% of nominal caliper.

TABLE 5

TYPICAL OCR PAPER CHARACTERISTICS - JOURNAL TAPE*

	Property Values and Test Methods Used							
Basis Weight† 500 Sheets 17 x 22 in	Opacity (Bausch & Lomb) Min	Smoothness‡ (Sheffield) Min	Max	Porosity (Gurley) Min	Stiffness, Either Direction (Gurley) Min	Tear, Either Direction (Elmendorf) Min	Caliper,§ Nominal Min	Max
11 lb (41.4 g/m^2)	65%	100	200	10 sec	12 mg	20 g	0.0020 in	0.0024 in
16 lb (60.2 g/m^2)	82%	100	200	10 sec	40 mg	32 g	0.0030 in	0.0036 in

*For a complete definition of typical OCR paper qualities, including dirt, reflectance, and fluorescence requirements, it is imperative that Section 2 and Appendix A be read in their entirety.

† Tolerance for this characteristic is ± 5% of nominal value.

‡ Certain OCR devices and applications may require a narrower range. Results are reported in Sheffield flow units.

§ Normal paper manufacturing tolerance within a run is ± 5% of nominal caliper.

APPENDIX (This Appendix is not a part of American National Standard Optical Character Recognition Paper, X3.XX-197X, but is included for information purposes only.)

Appendix A Dirt in Paper

As stated in Section 2.5.5 of the standard, there is at this time, no precise, reproducible method of measuring dirt for OCR applications. Dirt specifications, therefore, have not been included in the body of the standard. Table A1 reflects OCR paper dirt requirements commonly quoted in the industry. These values are intended to serve as a guide only.

Refer to Section 2.5.5 of the standard for methods of measuring dirt and appropriate definitions. It is the intention of this guide that both the parts per million and the mark count considerations be met for OCR papers.

Table A1
OCR Paper Classifications

OCR Paper Classification	Dirt Level (1) (Maximum)	Fluorescent Level (2) (Maximum)
Type I	10 parts/million and 150 marks/1,000 sq. in.	2.0% increase in reflectance
Type II	25 parts/million and 375 marks/1,000 sq. in.	2% increase in reflectance
Type III	25 parts/million and 375 marks/1,000 sq. in.	5% increase in reflectance

NOTE: (1) See section 2.5.5 for a discussion of the methods of measuring dirt in paper.

(2) See section 2.5.2 for a discussion of the method of measuring fluorescent content.